Health & Safety *Report*

Worker Health and Safety Branch

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PESTICIDE ILLNESS SURVEILLANCE PROGRAM

SUMMARY REPORT

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ABSTRACT

This document summarizes reports received by the Worker Health and Safety Branch of the Department of Pesticide Regulation (DPR) of illness or injury potentially caused by pesticide exposure. DPR received a total of 1,995 reports during 1994 that were referred to the county agricultural commissioners for investigation. Information sufficient for classification was received for 1,883 of the 1,995. Of the 1,883 interpretable cases, 1,332 (71 percent) were classified as possibly, probably or definitely related to pesticide exposure. Of those 1,332 cases, 1,211 (91 percent) derived from exposures that occurred while the affected person was at work (occupational exposures). About one-third of the cases involved exposure to agricultural pesticides.

Fewer pesticide-related cases were reported in 1994 than in any year since automated record keeping began in 1982. Reports concerning field workers continued at the low levels seen since 1989. Reports related to antimicrobials continued the annual decreases noted since 1991.

The cases investigated in 1994 included six crashes of aerial applicators, three of them fatal to the pilots. No evidence indicated pesticide involvement in any fatal crash. One non-fatal crash followed spontaneous ignition of the sulfur being applied. Two of ten pesticide ingestions reported during 1994 proved fatal. One additional fatality occurred when a tenant broke into his apartment while it was being fumigated.

INTRODUCTION

Under State law, [1] the California Department of Pesticide Regulation (DPR) receives reports of illness and injury suspected of having been caused by pesticide[a] exposure. These cases are referred for investigation to the agricultural commissioner in the county of occurrence. The investigative reports from the counties are evaluated by DPR staff. DPR's Worker Health and Safety Branch (WH&S) extracts data from the reports and enters them into a computerized database. This report documents and describes the reports of illness/injury received by WH&S during 1994.

The intention in maintaining these records is to document and evaluate the circumstances of exposures to pesticides that result in illness. This monitoring system serves to evaluate the effectiveness of the DPR pesticide and worker safety regulatory programs, alerting regulatory officials to possible pesticide-related problems. Information from the database feeds back into the regulatory programs and is used to develop or support enhancements for the California pesticide registration program and the U.S. Environmental Protection Agency's (U.S.EPA) Label Improvement Program.

MATERIALS AND METHODS

The Reporting System

Most reports investigated as potential cases of health effects caused by pesticides reach DPR by one of two routes. Legislation enacted in 1971 and amended in 1977 and 1995 requires all California physicians to report by telephone to the local health officer within 24 hours any illness or injury suspected of having been caused by pesticide exposure. The statute requires the health officer to transmit the information immediately to the county agricultural commissioner, and also to complete a pesticide illness report (PIR). Copies of PIRs are sent within seven days to the State Office of Environmental Health Hazard Assessment, the California Department of Industrial Relations (DIR, which enforces the reporting statute) and to DPR.

Additionally, WH&S staff review the doctor's first reports of work injury (DFRWIs) received by DIR. Submission of a DFRWI is required as part of the process by which physicians are compensated for treating workers injured on the job. Cases reported by DFRWIs are included for investigation if they mention pesticides as a potential cause of the illness or injury or if they mention chemicals as a cause in a situation in which pesticide use is likely.

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[a] "Pesticide" is used to describe the many substances used to control pests. Pests may be insects, fungi, weeds, rodents, nematodes, algae, viruses or bacteria--almost any living organisms that cause damage or economic loss, or transmit or produce disease. Pesticides, accordingly, include herbicides, fungicides, insecticides, rodenticides, and disinfectants, as well as insect growth regulators. In California, adjuvants also are subject to the regulations that control pesticides. Adjuvants are substances added to enhance the efficacy of a pesticide, and include emulsifiers, spreaders, and wetting and dispersing agents.

Specifically, cases are sent to the counties for investigation if the terms 'pesticide,' 'insecticide,' 'fungicide,' etc., appear, as well as if they mention a specific pesticidal product or ingredient. Mention of any 'chemical' as a possible contributor to the disease is sufficient to trigger an investigation if the work site is one that suggests pesticide use (e.g., farm, greenhouse or nursery), or if a structural pest control operator is involved. In 1994, 1,995 individual cases were assigned for investigation. This is the smallest number of cases identified since computerized tracking began in 1982.

WH&S sends all of the reports of cases of potential pesticide illness or injury to the county agricultural commissioner in the county of occurrence, where the commissioner's staff investigates the episodes. Although established procedures require local health departments to provide the county agricultural commissioners with copies of reports of possible pesticide-related illness, WH&S also includes copies of these PIRs in its mailings in case of oversight and in order to maintain a tracking system.

In their investigations, the commissioners attempt to document the circumstances under which exposure may have occurred, possible causal factors, apparent violations of pesticide regulations and any other pertinent information. They attempt to interview both the people affected and those responsible for training and supervising the affected people. If the circumstances suggest contamination of a crop or structure, and if not too much time has elapsed since the event, the commissioners follow a protocol for taking samples and sending them to a State laboratory for pesticide analysis.

Since the workers' compensation system is the primary source of case identification, it often is too late for meaningful sampling by the time the commissioners learn of an episode. The delay between the occurrence of an illness episode and investigation adds to the difficulty of locating and interviewing the people involved. However, the commissioners typically take the opportunity to perform inspections of the site where the incident occurred. If these efforts uncover violations of any regulations, whether or not they contributed to the episode under investigation, the commissioners take enforcement action where appropriate. The completed investigative reports are forwarded to WH&S for evaluation.

All reports of pesticide-related illness are investigated by the county agricultural commissioners and evaluated by DPR. A cooperative agreement among the U.S.EPA, DPR, and the California Agricultural Commissioners and Sealers Association, designates incidents that meet certain standards of severity for priority investigation. Priority investigations are especially comprehensive, although the evaluation at WH&S is directed towards extracting the same information as from other cases.

A case may qualify for priority investigation by extent of environmental effects (pollution of soil, water or air, or killing of non-target species), property loss, or human health effects. Among cases qualifying on the basis of human health effects, a priority investigation is conducted if a person dies, if a person is hospitalized for 24 hours or longer and receives therapy, or if five or

more symptomatic people seek medical evaluation. Summary reports of priority investigations are available to the public upon request.

Data Evaluation Procedures

The information received by WH&S is variable in focus and degree of detail. To use it as the basis for scientific and regulatory judgments, it is necessary to describe it in terms of a limited number of relevant characteristics. The objective of the evaluation is to describe each case report in terms of: (1) the adequacy of the information provided, (2) the evidence for pesticide exposure, and (3) the probability that the illness or injury reported was caused by the pesticide exposure described. Additional information also is recorded, including the medical nature of the complaint, the activity of the affected person at the time of exposure, and the availability and use of protective gear.

The determination of adequacy of information governs subsequent case classification. Staff of the Pesticide Enforcement Branch, as well as of WH&S, train the commissioners' staffs in the necessary components of investigation. However, when relevant information is not available (for instance, when neither the affected person nor that person's employer can be located), no conclusion can be made about the case.

Collecting evidence that a person was exposed to some pesticide or pesticides almost always includes identifying the chemical(s) involved. Recording the identity of the pesticide(s) is a central feature of this program. Most often, the circumstances of the episode implicate a single pesticide. In a substantial minority of cases, however, the affected person was in contact with multiple pesticides, any of which may have contributed to the problem. This occurs partly because people who work with pesticides regularly are likely to use different pesticides at different times, and partly because several pesticides may be combined in a single application or pesticide product.

When only one pesticide active ingredient is identified as associated with the episode, that active ingredient is identified as the primary pesticide. When multiple pesticides are present, it may be possible to identify one as the causal pesticide. If the affected person noticed being exposed to just one of various pesticides in use, that pesticide is entered as primary. Likewise, if the manifestations are incompatible with the other pesticides present (for instance, when cholinesterase inhibition is documented and only one of several reported pesticides is a cholinesterase inhibitor), then the implicated pesticide is entered as the primary pesticide. Otherwise, all of the pesticides identified, up to a total of ten, are recorded as associated pesticides. The term 'adjuvant' (covering such things as surfactants, emulsifiers, and spreaders/stickers) may be entered among the associated pesticides, but only pesticidal active ingredients are entered as primary pesticides. Whenever possible, pesticides are identified by the common names of their active ingredients. If the compound has no generally accepted common name, a brand name or chemical name is entered.

The relationship between exposure and illness or injury is classified as follows:

- Definite: The signs and symptoms exhibited by the affected person are such as would be expected to result from the exposure described. Both medical evidence (such as blood cholinesterase levels or allergy tests) and physical evidence (such as leaf samples or contaminated clothing) support the conclusion that the illness or injury was the result of the pesticide exposure. Because most of the cases are identified through workers' compensation, rather than being reported promptly through local health departments, investigations typically occur weeks to months after the event. Therefore, reports by a competent observer (such as the treating physician) are accepted as evidence.

- Probable: There is close correspondence between the pattern of exposure and the illness or injury experienced. Medical and/or physical evidence may not be available. For example, although symptoms may be highly suggestive of cholinesterase inhibition, without results of cholinesterase testing, the case would have to be entered as probable rather than definite.

Relationship classification is interpreted somewhat differently for indoor exposures (which tend to be prolonged and where dissipation is inhibited). In that situation, cases are classified as probable without specific indicators of causation. Development of symptoms compatible with pesticide toxicity within a day of entering an enclosed area treated within the prior three days is considered a probable case of pesticide illness, although the symptoms experienced generally are non-specific. Development of recognizable allergic symptoms on more than one occasion also provides evidence of a probable relationship, even if the affected person did not enter the treated area but only spent time in the same building.

- Possible: There is some correspondence between the pesticide exposure described and the illness or injury experienced. The information available may be ambiguous. Headaches, nausea, and skin rashes, for example, all can be caused by many different things; and sometimes people are uncertain exactly where they were working when a problem began. Such uncertainty will cause a case to be entered as possible.

In the case of indoor exposures, the additional uncertainty that causes a case to be classified 'possible' rather than 'probable' may derive from exposure to non-pesticidal substances in addition to the pesticide, from a time lapse of four days or more between application and exposure, or from information that the affected person did not spend time in the parts of the building that were treated.

- Unlikely: The exposure may be uncertain; the signs and symptoms reported are not typical of the exposure suspected, but the possibility that the victim is suffering the effects of pesticide exposure cannot be discounted. Uncertain exposures may be of people far from the application site, or who only handled tightly closed packages or thoroughly cleaned containers. As an example of signs and symptoms not typical of the suspected exposure: People who complain of constipation following contact with a pesticide known for causing diarrhea are unlikely to be

suffering the effects of the pesticide.

● Unrelated: Evidence is available to demonstrate that the illness or injury was caused by factors other than exposure to pesticides. Sometimes, a product that initially was thought to be a pesticide turns out to be something else, such as a fertilizer or cleaner. Other times, the attending physician determines that the problem is infectious, not toxic.

● Asymptomatic: The subject of the investigation was exposed to one or more pesticides, but suffered no illness or injury in consequence. Cholinesterase depression without symptoms falls in this category. Although this situation does not require filing an illness report, it may reflect lapses from good work practice. Pesticide safety regulations require review of work practices when cholinesterase levels are 20 percent depressed and removal from exposure for any employee whose cholinesterase is 30 percent depressed, regardless of symptomatology.

● Indirect: The illness or injury reported appears to have been caused, not by pesticide exposure, but by measures prescribed for avoiding pesticide exposure. People who develop heat stress through performing vigorous work in heavy protective clothing fall into this category, as do those who develop allergic reactions to rubber gloves.

The final two categories of this list were not used prior to 1989. In previous years, such cases were designated unrelated. Tangible evidence is required to assign a relationship of definite or unrelated. Circumstantial evidence of causality or lack of causality results in classification of a case as probable or unlikely. Probable and definite cases generally are combined in discussions and tables in this report. Similarly, cases classified as unlikely, unrelated, asymptomatic and indirect often are discussed as a group.

The category of possible relationship is the most ambiguous. In practice, it generally indicates that the people involved are known to have had contact with pesticides shortly before becoming ill or injured, but evidence is not available to indicate whether or not pesticide exposure caused their illness or injury. These cases are presented separately in tables in this report. Some degree of exposure to pesticides may be assumed for cases classified as possible, probable or definite.

DPR recognizes that pesticide products may be complex mixtures with various possible actions. It is DPR policy to consider any adverse health effect that results from pesticide exposure to be a pesticide-related illness or injury. For purposes of overall classification, the primary toxic effects of the active ingredient(s) *are not* distinguished from incidental effects such as nausea in response to odor.

Explicit criteria have been established for classifying the relationship to pesticide exposure of illnesses that occur in some of the more common situations, such as exposure to cholinesterase inhibitors or dermatitis among field workers. Copies of the classification criteria are available on request.

Information abstracted from the investigative reports and recorded in the database includes the type of illness or injury experienced, characterized as systemic[b], respiratory, eye and/or skin and as allergic, chronic[c] and/or fatal. The intended use of the pesticide that resulted in the incident is characterized as agricultural or non-agricultural. In this context, the definition of the term 'agricultural' is intuitive rather than regulatory. A pesticide is considered agricultural if it was intended for use to contribute to production of an agricultural commodity (including livestock). In a few ambiguous cases, primarily those in which commodities were being packed or processed, the classification as agricultural or non-agricultural was based on the standard industrial classification (SIC) of the employer. Preparation of fresh crops for market thus is considered agricultural, while canning and freezing are forms of manufacturing.

The date of application of the primary pesticide involved, its formulation type and toxicity category, the number of days of hospitalization required, the number of days lost from work, the date of injury, the age and sex of the injured person(s) and their activity at the time of exposure also are recorded. In 1991, the record was expanded to include indicators of the types of protective equipment used and factors that appear to have contributed to the episode. Violations of existing safety regulations constitute a particularly significant type of contributing factor. Investigators identify violations. Evaluators determine whether violations noted on investigations contributed to the incident. Recording a violation as a contributory factor does not depend upon enforcement action. The database also includes a text description of the incident with information on individual aspects of the case.

The data elements collected with respect to the cases reported during 1994 are the same as those used since 1991, including the revisions to activity classification adopted in 1989.

RESULTS

DPR received reports of 1,995 people whose health may have been affected by pesticide exposure in 1994, and forwarded the reports to the county agricultural commissioners for investigation. DPR and the commissioners have jurisdiction over pesticide sales and use, though not over manufacture. Investigation revealed that 86 of the 1,995 occurred in circumstances outside DPR jurisdiction, including one case assigned a priority investigation. The commissioners submitted investigation reports for 74 of the 86 cases outside their jurisdiction (including the priority investigation) as well as for all but six of the 1,909 cases for which they had jurisdiction. Preliminary information was sufficient to classify eight of the 18 cases without investigations. Of the 1,977 cases investigated, the reports contained sufficient information to classify 1,875 cases

[b] All signs and symptoms other than those limited to the skin, eyes or respiratory system are classified as systemic. Tables in this report include cases with respiratory symptoms in the systemic column.

[c] Chronic illnesses include both lasting effects of single exposures and ongoing reactions to ongoing exposures.

(95 percent), including 67 of the 74 investigated cases outside the commissioners' jurisdiction. This yielded a total of 1,883 classifiable cases. Of the 1,883 interpretable cases, 1,332 (71 percent) were classified as possibly, probably, or definitely related to pesticide exposure. Of those 1,332 cases, 1,211 (91 percent) derived from exposures that occurred while the affected people were at work (occupational exposures). These figures are presented in Table 1.

Total numbers of cases received during calendar years 1982 - 1994 are represented graphically in Figure 1. The numbers of reports of illness or injury summarized in this document exhibit a substantial decline in recent years.[2-13] The total number of cases investigated in 1994 was 5.5 percent below the comparable figure for 1993 (itself a 22 percent reduction relative to 1992) and 29 percent below the average from 1989 through 1992 (excluding cases related to the 1991 spill at Cantara). Figure 1 shows that, disregarding the cases related to the Cantara spill, numbers of cases were fairly consistent from 1989 through 1992.

Several large group episodes, described below, involved drift of cholinesterase inhibitors used in agriculture. Consequently, numbers of cases attributed to agriculture, to drift, and to cholinesterase inhibitors increased somewhat relative to 1993.

Age and Gender Distribution

Table 1A presents age and sex distributions of the people involved in the incidents summarized in this report. As in 1992 and 1993, the majority of them were in their 20's and 30's, and the average age of affected women was somewhat higher than of affected men. In agricultural settings, the ratio of males to females among those reporting illness following exposures to pesticides was still greater than four to one, as in previous reports. This reflects the predominance of males in agricultural employment. In other settings, there were roughly equivalent numbers of males and females reporting pesticide illness.

Two children under the age of ten developed symptoms following exposure to non-agricultural-use pesticides. One four-year-old was playing in the garage where some relatives stored their belongings. She found an unregistered insecticide, Miraculous Insecticidal Chalk™, mistook it for candy and ate it. She was found flaccid, lethargic and unresponsive and was taken to the hospital immediately. At the emergency room she received gastric lavage with activated charcoal and was observed in intensive care for a day. She was released the next day with no further complications. A notice was placed in the 'Action Report' published by the Medical Board of California, alerting physicians to the hazard of this product. Since it was not registered, no assurance of its composition is available; but analyses of confiscated samples have demonstrated deltamethrin to be the active ingredient. Agricultural biologists visited numerous discount retail outlets in the area. Those selling the product were issued cease-and-desist notices and their stocks of the illegal pesticide were impounded.

The other pediatric case involved another four-year-old who played with his cat shortly after the animal was sprayed with a flea spray containing a cholinesterase inhibitor. The child developed

symptoms that afternoon and was seen by a physician the next day. However, it was unclear whether symptoms were due to exposure to residue of the pesticide or to gastroenteritis, which might have caused the same problems.

Case Totals by Type of Illness

Table 1 shows the numbers of case reports received for different categories of illness, and the evaluations that were made of them with regard to the likelihood that they were caused by pesticide exposure. Of the 1,332 cases possibly, probably, or definitely related to pesticide exposure, 318 cases involved eye injury only. Skin problems resulted in another 173 cases and 23 cases included eye and skin symptoms without systemic or respiratory involvement. No hospitalization was required for any of the people whose symptoms were limited to eye and/or skin. The only chronic cases among these people involved ten people who had continuing skin irritation in response to continued exposure.

Table 1B presents the breakout of involved systems for those cases presented in the other tables as 'systemic' illnesses. Systemic symptoms (such as nausea and headache) were the only sort of symptom recorded in 223 of the 818 cases reported as systemic. Systemic symptoms were accompanied by eye or skin effects, but not respiratory symptoms, in 109 cases. Respiratory symptoms were recorded in 486 cases including 141 in which no systemic symptoms other than respiratory were reported. Irritant reactions (typically injuries to the eye and/or skin) were recorded in 278 of the 818 cases that had systemic symptoms.

Some indication of an allergic mechanism was recognized in 71 cases definitely, probably or possibly related to pesticide exposure. Of 28 cases definitely or probably related to pesticide exposure in which allergy was suspected, skin reaction was the only symptom reported in seven cases and five reported respiratory symptoms only. The other 43 potentially allergic cases were considered only possibly related to pesticide exposure. Eighteen of the 43 involved skin manifestations only and three respiratory only.

Case Totals by Type of Activity

Numbers of case reports in each activity category are presented in Table 2. The largest categories are those associated with the use of antimicrobials: mixer/loader for hand application (100 of 106); applicator by means other than aerial, ground or hand (223 of 231); drift exposure (87 of 229). Other activity classes where antimicrobials were important included: hand applicator (23 of 94); equipment maintenance (15 of 25); exposed to concentrate (16 of 30); packing or processing (23 of 26); 'other residue' (15 of 27); and 'other' occupational circumstances (28 of 64).

Three episodes involving more than ten people each exposed to field residue were reported in 1994. One episode involved 30 lettuce harvesters in Imperial County who, as a result of miscommunication, entered a field 15 hours into a 48-hour reentry interval. All 30 workers were

taken to the hospital for evaluation, although only 12 were symptomatic. An episode in San Diego County involved 15 grapefruit harvesters who became ill while working in a grove after the expiration of the required reentry interval. Application rates were within limits. An episode in a vineyard in Fresno County involved 12 harvesters who detected an odor and noticed powdery residue on the grape leaves. The rows adjacent to their work site were sprayed the previous day. The surveillance program recorded six additional episodes involving two or more field workers but fewer than five people each. In spite of the occurrence of three large group episodes, the cases in the field residue category decreased compared to those reported in 1993 and 1992. A total of 109 cases were attributed to exposure to field residue in 1994, compared to 117 in 1993 and 198 in 1992. This includes 62 systemic cases (29 possible, 33 probable or definite) and 42 skin cases (37 possible, 5 probable or definite). From 1989 through 1993, the program averaged 157 definite, probable or possible field residue cases annually. From 1982 through 1988, an average of 280 reports per year were evaluated as definitely, probably or possibly related to exposure to field residue of pesticides.

The broadly defined drift exposure category resulted in 295 cases where illness or injury was thought possibly, probably, or definitely related to pesticide exposure. This category includes all cases in which an application in progress resulted in exposure of people not involved in making the application. Agricultural applications resulted in 99 of the 229 occupational drift exposures and 58 of the 66 non-occupational drift exposures. Four episodes of drift from agricultural applications involved more than five people each. The largest involved 73 people waiting to pick up their paychecks from a citrus grower in Tulare County. An application of a combination of cholinesterase inhibitors drifted across the street onto the crowd of people. A notice of violation was issued to the grower for applying the pesticide in a hazardous manner. Another large episode involved 48 people exposed in Kings County when a cotton field was sprayed with a reformulated and highly odorous chlorpyrifos product. The application drifted from the target site, affecting 47 employees of a gas and electric utilities company and a child. Swab and leaf samples from the location were positive for residue. Another episode, also in Kings County, involved drift of sulfur onto a crew hoeing in a cotton field adjacent to the tomato field being treated. Twelve of the 22 workers developed eye irritation and the applicator was found to have violated safe application methods. The other episode occurred in Santa Barbara County, and involved six workers walking past an application to a broccoli field. Five of the people interviewed reported developing symptoms after smelling a strong odor.

The largest episode of drift from a non-agricultural application occurred when the regulator on a one-ton chlorine gas cylinder at a Butte County packing house leaked and the gas was blown into the work area, affecting 49 of the employees. Antimicrobials were implicated in another 38 of the occupational drift cases, frequently as a result of mixing with other products in violation of label directions.

Exposures that did not conform to any of the defined categories were classified as “other.” This category included 64 occupational exposures and 13 non-occupational exposures. Of the occupational exposures, accidents contributed to 33. These typically involved splashes or spills

resulting from mishaps such as bumping or dropping pesticide containers, dropping something else into a pesticide container, or inadvertently triggering pesticide release. Twenty-eight of the 64 occupational exposures were due to antimicrobials. Five of the 13 non-occupational cases were suicide attempts, while six were accidental. Two cases involved elderly persons and it was unclear whether ingestion of the pesticides was deliberate or accidental.

Hospitalization and Disability

Tables 3A and 3B present, by activity category, the cost of pesticide-associated illness or injury in hospitalization and lost work time. Of the 879 definite or probable cases, 19 reported a total of 108 days hospitalization. Two cases lacked information on whether or not hospitalization was required. One hundred sixty-four of the people definitely or probably affected by pesticides missed a total of 557 days of work, while one person was prevented from working for an indefinite period and information about disability was unavailable for 44. The 453 cases possibly related to pesticide exposure included three hospitalized for a total of eight days and 103 who missed 492 days of work as well as 20 without information on disability and one who was off work for an indefinite period.

Three people who ingested cholinesterase inhibitors required protracted hospitalization, resulting in a longer average length of hospitalization than has been observed in past years. One patient who deliberately ingested an unknown amount of pesticide needed 20 days of hospitalization. An elderly woman who had lost her sense of smell accidentally drank a pesticide stored in a soda bottle. Although she tried to spit out the liquid upon tasting it, she was hospitalized for 15 days with complications leading to installation of a pacemaker. An elderly man was hospitalized for 14 days following a pesticide ingestion. Information is not available as to whether this ingestion was intentional or not. After two weeks in the hospital, the patient died. Apart from these three ingestion cases, 16 other people were hospitalized a total of 59 days for problems definitely or probably related to pesticide exposure.

Among the occupational cases definitely or probably related to pesticide exposure, the mixer/loader, applicator activity categories have the most number of cases reporting disability. One case involved a mixer/loader removing the probe of a closed system to add rinse water to empty containers. Some of the mixture contaminated his clothing and he developed symptoms of cholinesterase inhibition. He was hospitalized for a day and missed 28 days of work. Another case involved a landscape worker who missed 13 days of work following exposure while assisting in mixing, loading and applying herbicides. Still another case involved a worker preparing to move a 400-gallon tank of metam-sodium. He disconnected a hose from the tank and metam-sodium spilled on his legs and inside his boots. This resulted in 16 days of lost work.

Table 3C shows rates and average length of hospitalization and disability in comparison to the experience of the preceding 12 years. Hospitalization is relatively rare, especially among cases related to antimicrobials and those rated only possibly related to pesticide exposure. Nearly one

quarter of the people affected by pesticide exposure lose at least one day's work beyond the day of exposure, though the great majority are back to work within a week. Antimicrobial exposure was implicated in 448 definite or probable cases, of which three cases were hospitalized and 66 cases reported missing 132 days of work. Among the 87 cases possibly related to antimicrobial exposure, none were hospitalized, but 15 missed a total of 236 work days. A housekeeper and a custodian missed 120 and 60 work days, respectively, because of irritant problems only possibly related to antimicrobial exposure.

Case Totals - Active Ingredients

Table 4 lists the numbers of cases associated with each active ingredient. The majority of the cases possibly, probably or definitely related to pesticide exposure (916 of 1,332) involved a single, identifiable active ingredient. Cases in which more than one active ingredient was involved are summarized by functional categories in Table 4. Presence of adjuvants (such as surfactants, emulsifiers, or spreaders/stickers) or synergists was not considered in assigning mixtures to functional categories. In a departure from previous practice, plant growth regulators were included with herbicides and defoliants rather than being classified as 'miscellaneous'. Similarly, pheromones and insect growth regulators were included as insecticides. All of the cases in which insect growth regulators were identified also involved at least one cholinesterase inhibitor. Because several episodes occurred in vineyards treated with fungicides and plant growth regulators, but not herbicides, these were assigned a separate category. The “miscellaneous” category covers such infrequently reported pesticide categories as molluscicides and wood preservatives, as well as a few unusual combinations of common types of pesticides.

Most of the numbers in Table 4 are so small that they are likely to show substantial random variation from year to year. It is also important in interpreting these figures to consider the number of people exposed to the different compounds, the circumstances in which they are exposed, the amounts used, and the types of effects observed. For example, the herbicide glyphosate is identified relatively frequently in investigations of pesticide-related illnesses and injuries. However, more than 80 percent of the people affected by glyphosate experienced only irritant effects (overall, somewhat over half the recorded cases include systemic or respiratory symptoms); and of the 515 pesticide-related hospitalizations recorded over the 13 years on file, none was attributed to glyphosate.

Case Totals - Antimicrobials

Antimicrobials are pesticides used to control microbial pests. They include sanitizers and disinfectants, but not fungicides. Antimicrobials are the most commonly used pesticides as well as the most frequently reported. All restaurants, food processors, and health care facilities use them daily. Many are available for home use as well. The antimicrobials most commonly associated with reports of illness or injury are chlorine gas (which typically is used to control bacterial

contamination of water) and sodium hypochlorite (chlorine bleach, which is often used to sanitize food processing equipment).

These as well as other antimicrobial compounds have additional uses unrelated to their pesticidal properties. For example, sodium hypochlorite is commonly used as a whitener and chlorine as a reagent in various industrial processes. Accordingly, products are available that are not registered as pesticides although they contain the same ingredients as a pesticide product. Cases are entered as pesticide-related for purposes of this report if it appears that the product that caused the injury was used or was to be used with the intention of controlling pests. That is, use of sodium hypochlorite as a sanitizer results in classification as a pesticide illness, even if the product used was sold as bleach with no pesticidal claims on its label and consequently was not required to be registered as a pesticide. Conversely, an injury caused by a registered pesticidal product will be recorded as unrelated to pesticides if the product was being used as a laundry whitener only.

Agricultural commissioners investigated 576 cases of illness or injury suspected of having been caused by antimicrobial exposure during 1994. Of these, 11 proved not to be related to pesticide exposure and 12 could not be evaluated due to lack of information. Of the remaining 553, there were 552 that involved occupational exposures and only one non-occupational case, which was evaluated as definitely related to exposure. Fourteen of the occupational cases were thought unlikely to be related to pesticide exposure, and three of the occupational cases were asymptomatic. There was also one indirect case. The 535 cases definitely, probably or possibly related to antimicrobial exposure compare to 582 cases so evaluated in 1993, 714 cases in 1992, 766 cases in 1991, and 847 in 1990, a 37 percent drop over four years.

Sodium hypochlorite remained the most commonly reported of all pesticides in 1994. It was associated with 163 definite or probable cases and 29 possible cases. Eye injury alone accounted for 101 of the definite or probable sodium hypochlorite cases and four of the possible cases. Fifty-one systemic cases were definitely or probably attributed to sodium hypochlorite exposure, including 19 with respiratory symptoms only and another 14 with respiratory manifestations in addition to other systemic symptoms. Exposure to chlorine gas occasioned 61 definite or probable case reports and four possible reports. All 61 of the definite or probable chlorine cases were systemic, 32 of which included respiratory symptoms. Quaternary ammonium compound exposures resulted in 78 definite or probable cases and 11 possible cases. Fifty-four of the definite and probable cases were eye injuries, and 18 involved skin only. Exposure to combinations of antimicrobials resulted in 48 definite or probable cases and 13 possible cases.

Although these numbers of case reports are much larger than those typically seen for other sorts of pesticides, they probably are not disproportionate in consideration of the amounts used and the number of people potentially at risk. We have no figures for the number of individuals potentially exposed to antimicrobial pesticides. It seems apparent, however, that the hundreds of complaints recorded represent a very modest risk for users of such ubiquitous substances.

Case Totals - County

The numbers of cases reported and the results of evaluation of those cases are listed in Table 5. No cases were reported from Alpine, Inyo, Lake, Mono, or Plumas County.

Besides the total numbers of cases in each likelihood category, Table 5 presents the numbers of those for which agricultural or non-agricultural pesticide use was implicated and a general classification of the exposure situation. This classification of exposure as relating to concentrate, to pesticide in use, or to residue is based on the activity of the people affected, and is applied to occupational exposures only. The following paragraph lists the activity categories included in each of these columns:

The column labeled 'Pesticide Concentrate' includes all exposures in response to emergencies (such as fires or spills), exposures in the course of manufacturing or formulation, and exposures to packaged products in the channels of trade. The 'Pesticide Use' column covers exposures of mixers, loaders, applicators, flaggers, people performing fumigations, and people exposed to drift. Exposure to residue, totaled in the 'Pesticide Residue' column, includes field residue, residue from structural applications, residues on commodities being packed or processed and any other residues, as well as exposure of people maintaining contaminated equipment. Occupational activities classified as "other" and all non-occupational exposures are excluded from this classification system. The columns headed ‘Agric’ and ‘Non-Agric’ reflect the purpose in using the pesticides to which the affected people were exposed, as documented in the materials and methods section.

Fatalities

Investigations of seven deaths that occurred in 1994 revealed three clearly caused by pesticide over exposure, three without relation to pesticides, and one that could not be evaluated. The three separate episodes in which pesticide exposure caused death involved two aging men who ingested malathion and one tenant who entered his apartment through a window while the building was being fumigated with sulfuryl fluoride. None of the victims indicated the reasons for their fatal actions.

Of three aerial applicators who died in crashes, two were known to have hit power lines. The cause of the third crash was not apparent. The agricultural commissioner investigated the crash because exposure to some neurotoxic pesticides may compromise alertness and good judgment, leading to accidents. That could not be a factor in this case, as the pilot had applied nothing but sulfur for the preceding month. Information was not available to indicate whether or not the sulfur being applied might have caused or contributed to the crash by spontaneous combustion. This case, consequently, was left unclassified.

The most perplexing of the fatalities investigated concerned a cancer patient who suffered a heart attack in a hospital emergency room. Several of the medical personnel attending her developed

symptoms after noticing an odor, while others were unaffected. For a period, some speculated that pesticide toxicity may have contributed to this episode. No one explained the basis for this theory, which was discounted after investigation.

Chronic Illness

The possibility of chronic illness was recognized in 30 cases reported during 1994. Two of them could not be evaluated due to lack of information, nine were found not to have been caused by pesticides, and one was unlikely to have been caused by pesticides. Of the other 18 cases, 15 were judged possibly related to pesticide exposure, two probably related, and one was related indirectly in that the impervious clothing worn by the affected pesticide applicator exacerbated a fungal infection.

The cases that could not be evaluated involved a busboy whose hand may have been irritated by bleach (the young man could not be located for interview) and a structural pest control operator whose asthma never was attributed to a specific cause. Reassignment to a sales position and medication controlled his symptoms. Of the nine cases not related to pesticide exposure, eight involved people not exposed to pesticides. The ninth concerned a man who had made numerous applications of diquat using a backpack sprayer prior to developing degenerative kidney disease. Diquat is nephrotoxic, but a biopsy resulted in diagnosing this man's problem as Buerger's disease, a vascular disorder quite different from the tubular necrosis characteristic of diquat poisoning.

The one unlikely case involved a grape pruner, the only member of a crew of eight to develop skin irritation while working in a vineyard treated with herbicides about three weeks earlier. Five months later, she still had hives.

Eleven of the 15 chronic cases possibly related to pesticide exposure involved chronic use of irritating sanitizers. The others involved a bus driver who developed non-specific symptoms after driving a bus that had been treated for roaches, a retail store employee who developed asthma following a structural application at the store, an applicator of herbicides whose non-specific symptoms resolved when he was reassigned, and a homeowner who developed a severe peripheral neuropathy following his second treatment of his home with a cholinesterase inhibitor.

One of the probable cases involved an asthmatic homeowner whose condition apparently was aggravated following professional treatment of his house. The other concerned an agricultural laborer assigned to assist in methyl bromide applications to fields. The investigation indicated numerous shortcomings in safety practices, with a distinct possibility that the worker was permanently impaired by exposure.

Contributory Factors

Recording of aspects of pesticide exposure situations that appeared to have contributed to the development of health problems, instituted in evaluation of 1991 case reports, has continued

unmodified through 1994. Staff members evaluating and abstracting case information were asked to indicate whether the affected person was unusually susceptible, whether the exposure was deliberate, whether equipment failure or some other type of accident had resulted in the exposure, whether the people affected had come into direct contact with the pesticide, and whether they had smelled the pesticide. Among violations of safe pesticide use practices, evaluators were asked to distinguish among reentry during a restricted period, failure to use required protective equipment, and any other form of misuse. Evaluation of the role of violations is limited by the fact that episode investigation reports may be submitted before enforcement action is complete.

Of the 1,332 people definitely, probably, or possibly affected by pesticide exposure, 388 had been in direct contact with the pesticide and 435 reported smelling it. Of the people who reported odor, only five had direct contact. Reported violations of required procedures contributed to 452 of the 1,332 cases, including 88 of 295 drift exposures. Among the 157 exposures to drift from agricultural applications, the applicator was thought to be at fault in 76. Failure to use required safety equipment contributed to 249 of the 1,332 cases, including 78 in which additional violations were identified. Equipment failures contributed to 104 cases, including 39 of the 388 people who had direct contact with the pesticide and 56 of the 435 who smelled it. Accidents contributed to another 55 direct exposures. Violations were recorded in 18 of the 104 cases with equipment failures (including 16 of the 39 that resulted in direct contact) and 29 of 111 accidents (including 19 of the 55 that led to direct contact).

Of the 1,332 affected people, 402 were exposed while making or preparing to make non-agricultural applications. Of those 402, there were 141 not using required safety equipment, 44 affected by other violations, and 60 were involved in violative applications as well as failing to use the equipment required. The typical situation in this category involved use of a sanitizer, often in a food service or health care setting, without wearing goggles or a face shield. People making or preparing for agricultural applications were affected in 129 cases, including 18 who did not use required safety equipment, 17 affected by other violations, and 12 affected by violations while not using required equipment. Among 109 agricultural fieldworkers definitely, probably or possibly affected by pesticide exposure, early reentry was a factor in 22 cases.

Among the 1,332 affected people, eight had been exposed to pesticides deliberately. One hundred twenty-one of the 1,332, none of whom was exposed deliberately, were recognized as being particularly susceptible. Sixty of the susceptible people reported smelling the pesticide. The susceptible people included 36 asthmatics, all but one of whom reacted to exposure with an asthma attack. Five other people had various chronic conditions including bronchitis, eczema and cardiac arrhythmia that made them more than usually vulnerable. Seven women were pregnant when exposed, including five at work in a food processing plant when a mechanical failure released chlorine gas into the air. The fact that the people affected had suffered similar previous episodes provided the basis for inferring susceptibility in 16 cases, while 37 people described themselves as sensitive to chemicals or odors, two as sensitive to the particular type of pesticide to which they were exposed, six as allergic to various substances, and one person was allergic to the specific pesticide. The people who described themselves as sensitive to chemicals included 21

of the 73 recently discharged agricultural workers who were drifted upon while waiting to receive their pay.

Among people exposed while participating in a pesticide application (pesticide handlers), direct contact with the pesticide was the predominant risk factor. Forty-four of 128 agricultural pesticide handler cases reported direct contact with the pesticide, as did 251 of 402 cases of handlers of non-agricultural pesticides. Failure to use required safety equipment contributed to 19 of the agricultural and 187 of the non-agricultural direct exposures of pesticide handlers. The 402 cases of non-agricultural pesticide handlers included 337 applying antimicrobials, of whom 249 suffered eye and/or skin problems only--resulting from direct contact in 216 of the 249 cases.

In non-agricultural settings, violations of safety regulations were not major contributors to exposures to residue or drift. Insufficient care on the part of the applicator was found to have contributed to 76 of the 295 agricultural drift exposures, including the 52 symptomatic members of the group of 73. Violation of a reentry interval contributed to 22 of 122 cases attributed to exposure to residue of agricultural applications. Odor was the most consistent factor identified in drift and residue exposures: Odor was recorded in 117 of 157 agricultural drift cases, 83 of 138 non-agricultural drift cases, 41 of 149 agricultural residue cases, and 130 of 238 non-agricultural residue cases. Table 6 shows the disproportionate contribution of cholinesterase inhibitors, many of which generate odorous breakdown products, to cases in which odor was recorded.

Group Episodes

A group episode is defined as illness or injury of more than one person deriving from a single episode of apparent exposure to pesticide. In 1994, DPR recorded 626 cases involved in 100 group episodes. Eight of the cases were involved in episodes initially reported and recorded in 1993. Another 30 cases related to seven episodes that occurred in 1993 but were reported during 1994. The other 588 cases derived from 88 episodes that occurred in 1994. Insecticides that inhibit cholinesterase were identified in 38 episodes that involved a total of 346 people. Antimicrobials were suspected in another 16 episodes in which 90 people were involved. The other 46 episodes with 190 people concerned other sorts of pesticides, or none at all. Eighteen of the group episodes, involving 74 people, proved unrelated to pesticides.

Twenty-seven episodes, including 267 case reports, occurred in agricultural settings. One episode, involving two people and no pesticide, could not be categorized as agricultural or non-agricultural. The other 42 episodes and 357 cases were non-agricultural.

Nine of the agricultural episodes involved drift, and 13 involved pesticide residues. The largest single episode occurred in Tulare County, where an insecticide application drifted across a road and onto at least 73 former employees waiting to pick up their final paychecks. The largest of the residue episodes occurred in Imperial County when a crew of 30 began harvesting lettuce less than a day after it was treated (mistakenly) with mevinphos, for which a 48-hour reentry interval was required at the time. (Mevinphos is no longer registered for use.)

Of the non-agricultural episodes, drift (13) and structural residue (24) were the predominant categories. Non-agricultural drift included all the people not involved in making pesticide applications who may have been exposed to pesticides in use for other than agricultural reasons. These most frequently involved antimicrobial pesticides, particularly when they generated irritating fumes after being mixed inappropriately with other products.

Most of the group episodes were small. Fewer than five people were involved in each of 68 episodes that included 162 people in all. Of the remaining 32 episodes, 10 (221 people involved) occurred in agricultural situations and 22 (with 243 people) were non-agricultural.

Priority Investigations

Under the terms of a cooperative agreement among the US Environmental Protection Agency, DPR, and the California Agricultural Commissioners' and Sealers' Association, involvement of five or more people in a group episode is sufficient reason to assign the episode for priority investigation. The 32 episodes identified above in which five or more people were involved gave rise to 28 priority investigations. Three episodes in which 19 people reacted to chemicals other than pesticides, and one incident in which no adverse effects occurred in any of the nine people exposed when a child broke a pesticide bottle, did not receive priority designations. In addition, one episode reported during 1993 and involving five people received priority designation in 1994. Among the 29 priority investigations of group episodes, four (involving 27 case reports) revealed no pesticide exposure.

The 25 priority investigations of group episodes in which investigation identified some pesticide exposure included 209 people exposed to agricultural pesticides in eight episodes and 205 in 17 episodes with other exposures. Of the eight agricultural episodes, four involved drift onto 139 people (including the 73 ex-employees mentioned in the previous section), three involved exposure of 57 workers to field residue (including the 30 lettuce harvesters previously mentioned) and one involved 13 people exposed to residue from a fumigation while processing harvested almonds.

The 17 non-agricultural group episodes included eight in which a total of 99 people were exposed to residues of structural applications. These cases were classified as either probably or possibly related to the exposure, except for ten people whose symptoms began prior to the application. Four non-agricultural drift episodes involved five people disturbed by the odor of an application to rangeland, 49 workers exposed to an accidental release of chlorine gas at a food processing plant, and 18 people involved in two episodes in which pesticides applied outside their workplaces were drawn into the air conditioning. The remaining five non-agricultural episodes involved a group of six maintenance workers exposed to leaking pesticide containers, seven hospital employees affected by a spill of a sterilant, ten employees of an auto dealership where a pesticide bottle broke, two people who ingested pesticides in separate incidents, and the nine people (eight hospital employees and a police officer) who became exposed while helping the two who swallowed pesticide.

The two people who ingested pesticides and exposed hospital personnel to the toxicant were among a total of ten reports of pesticide ingestion (two fatal) received during 1994. Two of the ingestions, in particular, clearly were unintentional: A well-meaning relative brought pesticide in a soft drink bottle to an aging woman's home, where she drank a mouthful of it. And a four-year-old child, familiar with a candy that resembles chalk, was found flaccid in her yard after eating a pesticide made to resemble chalk. Both of these people recovered. These cases illustrate the danger of making pesticides accessible without clear identification.

In addition to the ten people hospitalized for pesticide ingestion (including two who gave rise to group episodes), priority investigations were assigned on the basis of severe effects on 18 other individuals. Seven of the 18 were exposed at their homes; the other eleven experienced mishaps at work.

Three of the seven exposed at home were people who applied pesticides to their residences. One man who became ill after treating his yard with diquat was found to have an infection and not a toxic problem during his hospital stay. Two other people both had made heavy, repeated insecticide applications indoors and were hospitalized with complex and severe symptoms that never were diagnosed with certainty. The other four non-occupational priority investigations concerned people exposed to pesticides applied by professionals: One person with a chronic disease was hospitalized after trees at her apartment complex were treated with a pyrethroid insecticide; this hospitalization was evaluated as unrelated to the pesticide exposure. One young man died after entering a building under fumigation; he climbed through a window into the apartment he shared with his family. An asthmatic suffered an attack that required hospitalization after his home was treated by an exterminator. Another asthmatic was hospitalized for an attack that occurred following spraying to eradicate Mediterranean fruit flies.

Two more asthmatics were hospitalized for attacks following exposures at work: One followed a structural application to an office; the other involved a vineyard employee who continued to apply dusting sulfur, with elaborate precautions, despite his condition. A convenience store employee who inhaled fumes from a broken bottle of muriatic acid developed breathing difficulty and had a seizure, leading to hospitalization. A landscape worker was hospitalized with pneumonitis that may have been a reaction to inhalation of the herbicides he applied. Miscommunication led a structural pest control operator to introduce fumigant into a tarped building while two of his coworkers were still inside it. One of the two was hospitalized.

Two agricultural workers were hospitalized for cholinesterase inhibition. One of these was a mixer/loader, and his exposure was well-documented. The other was a grape harvester who ate some of the grapes. Her cholinesterase activity was well below the normal range, although no cholinesterase inhibitor had been applied to the grapes. No other source of exposure could be identified, and failure of her cholinesterase activity to increase over time led to the conclusion that the value was normal for this worker.

Six crashes of aerial applicators (three fatal) were investigated in 1994, four of which were assigned priority status. Mechanical reasons for the crashes were apparent in five of the six cases, including one in which dusting sulfur ignited spontaneously. One fatal crash was left unclassified. The pilot in that case had applied only sulfur during the preceding month, so he was not thought to be impaired by pesticide toxicity. No evidence was available, however, to evaluate whether the sulfur might have contributed to the crash via spontaneous combustion.

Three hospitalizations in addition to that of an aerial applicator were investigated without priority designation. Two of them were unrelated to any pesticide exposure; the third involved an asthma attack following exposure to fumes generated when bleach was added to a bottle containing a small amount of an unknown substance.

Six priority investigations were assigned during 1994 on the basis of property loss. No other type of environmental effect required priority investigation this year.

DISCUSSION

Reporting

This registry is based on mandatory physician reporting. State laws require physicians to report all pesticide illnesses to the local health department and all occupational illnesses to the Department of Industrial Relations. Illnesses among people who, for whatever reason, do not consult a physician are unlikely to be identified. Additionally, although physicians have a responsibility to report any patient whose problems may have been caused by pesticide exposure, in practice most cases investigated are occupational exposures located primarily through the workers' compensation system. Although this should be sufficient to identify any serious problems with pesticide use, it limits the conclusions that can be drawn about the total number of people affected. In addition, the time lag inevitable in collecting reports from the workers' compensation system compromises the completeness of the subsequent investigation.

The DPR initiated an effort in 1994 to improve physician familiarity and compliance with the reporting requirement. In cooperation with DIR, DPR sent summaries of the requirements for reporting pesticide-related conditions to all physicians who held active California medical licenses. Procedures for logging new cases were modified to record the identity of the physician responsible. During 1995 and 1996, DPR will send letters to doctors who report pesticide cases to workers' compensation but not to the surveillance program.

Classification

Classification of cases as definite, probable, possible, unlikely or unrelated expresses the level of certainty that the illness described resulted, at least in part, from pesticide exposure. In interpreting the figures in this report, it is important to remember that some sorts of exposures

and illnesses are easier to ascertain than others. Eye injuries in particular are much easier to attribute to specific causes than other types of symptoms. Most common systemic symptoms are compatible with numerous causes, though certain manifestations are highly suggestive of cholinesterase inhibition, and respiratory symptoms are characteristic of inhalation exposures. Table 7 shows the distribution of relationships assigned by category of pesticide and type of symptom.

Use of the scaled relationship classification (definite, probable, possible, etc.) recognizes the uncertainties that typically remain after even the most diligent investigation, and the consequent inevitability of some degree of misclassification. For most variables, misclassification will obscure relationships that exist--for instance, all pesticides and all exposure scenarios will appear to carry more nearly the same risk than if classification were error-free. Consideration of the cases for which uncertainty is least (those classified definite or probable) should reduce misclassification bias and clarify relationships.

Evaluation of the contribution of violations of pesticide use regulations may be particularly susceptible to distortion. Both employers and employees may be motivated to exaggerate compliance and downplay the role of violations, especially when interviewed by enforcement personnel. Investigators, who are also enforcement agents, may over emphasize detection of violations. The contributions of these opposing tendencies cannot presently be evaluated.

Analysis

Observing a sixth consecutive year of low numbers of reports regarding field workers generates optimism that this may reflect a real improvement in safe use of pesticides. Prior to 1989, the surveillance program recorded an average of 280 cases per year definitely, probably or possibly attributed to exposure to field residue. Since then, we have recorded an average of 149 cases per year. This reflects primarily a drop in irritant cases, from an average of 218 to 98 reports per year. At the same time, the average number of case reports evaluated as unlikely to be related to field residue dropped from 87 to 45 and the average number of reports from field settings that could not be evaluated because of missing information dropped from 132 to 24. The decreases followed withdrawal of the insecticide phosalone and lengthened reentry intervals for the pesticides methomyl and propargite. The decrease in cases related to antimicrobials has been gradual and consistent over the years of data collection. It corresponds to no change in product availability or use restrictions, but may reflect educational efforts on the part of both industry and enforcement staff. DPR has made no change of policy or procedure in locating cases to investigate, and we know of no change at DIR that might contribute to the decline.

The significance of odor in exposures to pesticide drift and residue is uncertain. Odor certainly indicates presence of some foreign compound in the atmosphere, though not necessarily the toxic species. Several organophosphate pesticides liberate mercaptans that are not effective pesticides but are much more volatile and malodorous than the parent compound. A 1980 monitoring study[14] of the organophosphate cotton defoliant DEF and its breakdown product, butyl

mercaptan, detected the mercaptan at concentrations up to 10 parts per billion; the concentrations of DEF detected ranged from below the limit of detection (0.001 parts per trillion) to 0.034 ppt. Epidemiologic investigation of health complaints[15] related to another organophosphate (ethoprop, which liberates propyl mercaptan) revealed that odor was the strongest predictor of symptoms, while proximity to the exposure source did not predict symptomatology. Common experience suggests that exposure to a noxious odor often results in somatic symptoms, although the mechanism is uncertain.

Poison control centers are very familiar with the importance of keeping toxic substances in their original, clearly labeled containers. Two 1994 pesticide poisoning cases illustrate the danger of neglecting this basic precaution: An unsuspecting elderly woman drank pesticide brought to her home in a soft drink bottle, and a child ate an unregistered pesticide formulated to resemble chalk. Both recovered following hospitalization, but the distress they and their families experienced could have been avoided easily.

Acknowledgments

This report is an attempt to summarize information collected through the year-round efforts of dozens of workers. Space prevents explicit recognition of the enforcement staff and county investigators whose work provides the basis of this report. Special thanks are due to Don Richmond, without whose careful oversight the system could not function. Other Worker Health and Safety staff members who made essential contributions to this work include:

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FIGURE 1: ILLNESSES/INJURIES REPORTED

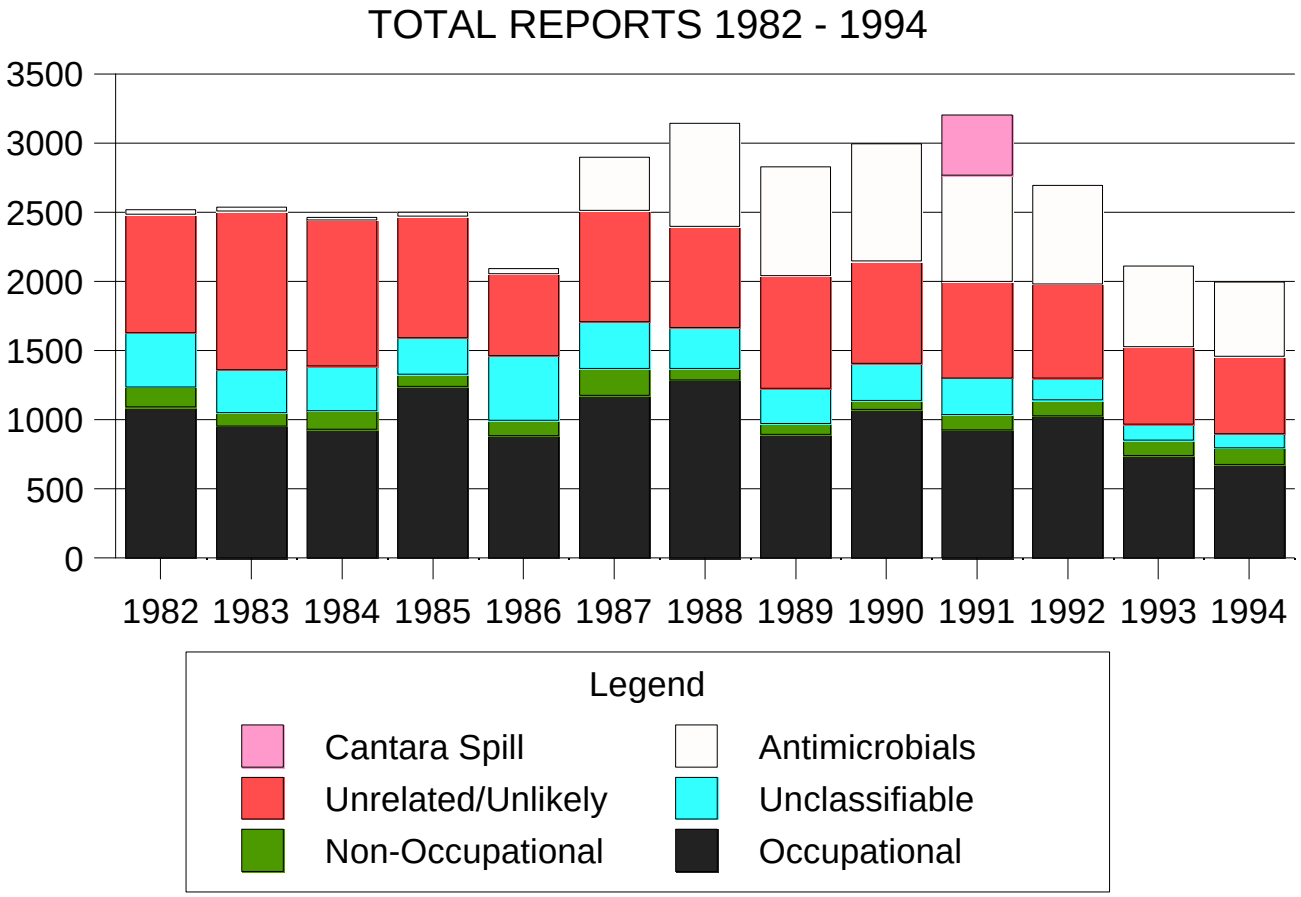

TABLE 1
Summary of Illness/Injury Associated with Suspected Pesticide Exposure
Reported by California Physicians
1994

Type of Illness	Adequate or Complete Data											Incomplete Data	
	Occupational					Non-Occupational					All Unrelated	Insufficient	Unavailable
	Def[1]	Pro[2]	Pos[3]	Unl[4]	Ind[5]	Def[1]	Pro[2]	Pos[3]	Unl[4]	Ind[5]			
Systemic	53	392	265	42	0	11	40	57	4	0	193	20	30
Eye	239	45	30	7	0	1	0	3	0	0	116	5	3
Skin	37	42	87	21	2	0	1	6	0	0	89	6	13
Eye/Skin	14	4	3	0	0	0	0	2	0	0	9	0	0
None/ND*	0	0	0	0	0	0	0	0	0	0	78	15	10
Subtotal	343	483	385	70	2	12	41	68	4	0	485	46	56
Total	**1283**					**125**					**485**	**102**	

* Not Determined; a relationship and/or illness type could not be determined from the information available

[1] Def = Definitely related to pesticide exposure
[2] Pro = Probably related to pesticide exposure
[3] Pos = Possibly related to pesticide exposure
[4] Unl = Unlikely related to pesticide exposure
[5] Ind = Indirectly related to pesticide exposure

TABLE 1A
Age Distribution of Cases Definitely, Probably or Possibly Related to Exposure to Pesticides
1994

Age Group	Agricultural			Non-Agricultural		
	Male	Female	Unknown	Male	Female	Unknown
Age Unknown	8	5	0	15	25	2
< 10 years	0	0	0	1	1	0
10 - 14.9	1	0	0	1	4	0
15 - 19.9	11	2	0	15	21	0
20 - 29.9	104	19	0	147	96	0
30 - 39.9	118	39	0	126	136	0
40 - 49.9	64	21	0	60	104	0
50 - 59.9	37	5	0	34	53	0
60 + years	11	3	0	22	21	0
Total	354	94	0	421	461	2

TABLE 1B
Number of Cases Classified as Systemic by Types of Symptoms Reported and Degree of Relationship

Symptomatology Reported	Probability of Relationship			Total
	Definite	Probable	Possible	
Respiratory & Other Systemic				
including topical (eye and/or skin)	5	82	34	121
without topical effects	19	136	69	224
Systemic but not Respiratory				
including topical effects	5	52	52	109
without topical effects	12	85	126	223
Respiratory Effects				
including topical effects	9	25	14	48
without topical effects	14	52	27	93

TABLE 2*
Illnesses and Injuries Associated with Exposure to Pesticides
Reported by Physicians in California
Summarized by Activity and Type of Illness/Injury
1994

ACTIVITY	ILLNESS/INJURY TYPE								Total	
	Systemic		Eye		Skin		Eye/Skin			
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
Mixer/Loader, Aerial	3	2	1	0	0	0	0	0	4	2
Mixer/Loader, Ground	1	2	7	0	5	1	1	0	14	3
Mixer/Loader, Hand	24	0	69	0	10	0	3	0	106	0
Applicator, Aerial	1	0	0	0	0	0	0	0	1	0
Applicator, Ground	1	23	7	6	8	5	0	1	16	35
Applicator, Hand	18	21	28	7	8	8	4	0	58	36
Applicator, Other	48	20	108	4	23	24	4	0	183	48
Fumigation, Chamber	0	3	0	0	0	0	0	0	0	3
Fumigation, Field	3	3	1	1	2	0	0	0	6	4
Fumigation, Tarpaulin	2	1	0	0	0	0	0	0	2	1
Flagger	0	0	0	1	0	0	0	0	0	1
Exposed to Drift	152	53	14	2	4	2	2	0	172	57

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TABLE 2 (Continued)
Illnesses and Injuries Associated with Exposure to Pesticides
Reported by Physicians in California
Summarized by Activity and Type of Illness/Injury
1994

ACTIVITY	ILLNESS/INJURY TYPE								Total	
	Systemic		Eye		Skin		Eye/Skin			
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
Repair/Maintenance	7	3	11	1	1	1	1	0	20	5
Pack/Process (Commodity)	2	13	3	1	1	5	0	1	6	20
Exposed to Field Residue	33	29	0	4	5	37	0	1	38	71
Structural Residue	96	62	0	1	2	3	2	0	100	66
Other Residue	6	13	3	1	4	0	0	0	13	14
Manufacture/Formulation	1	0	0	0	0	0	0	0	1	0
Exposed to Concentrate	7	3	16	1	2	1	0	0	25	5
Emergency Response	11	0	0	0	0	0	0	0	11	0
Other	29	14	16	0	4	0	1	0	50	14
Non-Occupational - less fully reported than occupational cases										
Application	5	2	1	0	0	0	0	0	6	2
Exposed to Drift	8	47	0	3	0	6	0	2	8	58
Exposed to Residue	28	6	0	0	0	0	0	0	28	6
Other	10	2	0	0	1	0	0	0	11	2
TOTALS	**496**	**322**	**285**	**33**	**80**	**93**	**18**	**5**	**879**	**453**

TABLE 3A*
Hospitalization and Disability Associated with
Illnesses/Injuries Probably or Definitely Related to Pesticide Exposure
1994

ACTIVITY	TOTAL CASES	HOSPITALIZATION				DISABILITY			
		Number of Cases			Total Days Reported	Number of Cases			Total Days Reported
		Unk[1]	Indef[2]	Rep[3]		Unk[1]	Indef[2]	Rep[3]	
Mixer/Loader, Aerial	4	0	0	1	1	1	0	3	44
Mixer/Loader, Ground	14	0	0	0	0	0	0	2	8
Mixer/Loader, Hand	106	0	0	2	4	3	0	25	58
Applicator, Aerial	1	0	0	1	18	1	0	0	0
Applicator, Ground	16	0	0	0	0	0	0	1	1
Applicator, Hand	58	0	0	1	2	1	0	12	40
Applicator, Other	183	0	0	0	0	5	0	26	56
Fumigation, Field	6	0	0	0	0	0	0	3	23
Fumigation, Tarpaulin	2	0	0	1	1	0	0	1	5
Exposed to Drift	172	0	0	0	0	1	0	22	33
Repair/Maintenance	20	0	0	0	0	1	1	7	16
Pack/Process (Commodity)	6	0	0	0	0	1	0	2	5
Exposed to Field Residue	38	0	0	1	1	12	0	7	9

[1] Unknown whether or not hospitalization/disability occurred.

[2] Duration of hospitalization/disability not reported.

[3] Duration of hospitalization/disability reported as one or more days.

***Continued on the next page**

TABLE 3A (Continued)
Hospitalization and Disability Associated with
Illnesses/Injuries Probably or Definitely Related to Pesticide Exposure
1994

ACTIVITY	TOTAL CASES	HOSPITALIZATION				DISABILITY			
		Number of Cases			Total Days Reported	Number of Cases			Total Days Reported
		Unk[1]	Indef[2]	Rep[3]		Unk[1]	Indef[2]	Rep[3]	
Structural Residue	100	0	1	0	0	0	0	39	144
Other Residue	13	0	0	0	0	0	0	3	7
Manufacture/Formulation	1	0	0	0	0	1	0	0	0
Exposed to Concentrate	25	0	0	1	1	6	0	2	2
Emergency Response	11	0	0	0	0	0	0	2	2
Other	50	0	0	1	2	2	0	3	7
Non-Occupational - less fully reported than occupational cases									
Application	6	0	0	1	2	1	0	0	0
Exposed to Drift	8	0	0	0	0	1	0	1	4
Exposed to Residue	28	0	0	1	2	1	0	3	93
Other	11	1	0	8	74	4	0	0	0
Total Probable and Definite Cases	**879**	**1**	**1**	**19**	**108**	**42**	**1**	**164**	**557**

[1] Unknown whether or not hospitalization/disability occurred.

[2] Duration of hospitalization/disability not reported.

[3] Duration of hospitalization/disability reported as one or more days.

TABLE 3B*
Hospitalization and Disability Associated with
Illnesses/Injuries Possibly Related to Pesticide Exposure
1994

ACTIVITY	TOTAL CASES	HOSPITALIZATION				DISABILITY			
		Number of Cases			Total Days Reported	Number of Cases			Total Days Reported
		Unk[1]	Indef[2]	Rep[3]		Unk[1]	Indef[2]	Rep[3]	
Mixer/Loader, Aerial	2	0	0	0	0	0	0	1	7
Mixer/Loader, Ground	3	0	0	0	0	0	0	1	10
Applicator, Ground	35	0	0	1	1	2	0	10	25
Applicator, Hand	36	0	0	0	0	2	0	9	18
Applicator, Other	48	0	0	0	0	2	1	8	148
Fumigation, Chamber	3	0	0	0	0	3	0	0	0
Fumigation, Field	4	0	0	0	0	0	0	2	9
Fumigation, Tarpaulin	1	0	0	0	0	0	0	1	3
Flagger	1	0	0	0	0	0	0	1	3
Exposed to Drift	57	0	0	0	0	0	0	22	103
Repair/Maintenance	5	0	0	0	0	0	0	3	17
Pack/Process (Commodity)	20	0	0	0	0	0	0	3	17

[1] Unknown whether or not hospitalization/disability occurred.

[2] Duration of hospitalization/disability not reported.

[3] Duration of hospitalization/disability reported as one or more days.

***Continued on the next page**

TABLE 3B (Continued)
Hospitalization and Disability Associated with
Illnesses/Injuries Possibly Related to Pesticide Exposure
1994

ACTIVITY	TOTAL CASES	HOSPITALIZATION				DISABILITY			
		Number of Cases			Total Days Reported	Number of Cases			Total Days Reported
		Unk[1]	Indef[2]	Rep[3]		Unk[1]	Indef[2]	Rep[3]	
Exposed to Field Residue	71	0	0	0	0	3	0	11	41
Structural Residue	66	0	0	1	5	1	0	21	72
Other Residue	14	0	0	0	0	0	0	4	11
Exposed to Concentrate	5	0	0	0	0	1	0	1	1
Other	14	0	0	0	0	2	0	5	7
Non-Occupational - less fully reported than occupational cases									
Application	2	0	1	0	0	2	0	0	0
Exposed to Drift	58	0	0	1	2	2	0	0	0
Exposed to Residue	6	0	0	0	0	0	0	0	0
Other	2	0	0	0	0	0	0	0	0
Total Possible Cases	**453**	**0**	**1**	**3**	**8**	**20**	**1**	**103**	**492**

[1] Unknown whether or not hospitalization/disability occurred.

[2] Duration of hospitalization/disability not reported.

[3] Duration of hospitalization/disability reported as one or more days.

TABLE 3C
A Comparison of Rates and Average Length of Hospitalization and Disability between 1994 and Previous Years (1982-1993)

	Percent of Cases Hospitalized				**Average Number of Days Hospitalized**			
	Definite/Probable		Possible		Definite/Probable		Possible	
Type of Pesticide	1994	1982-1993	1994	1982-1993	1994	1982-1993	1994	1982-1993
Antimicrobials	0.7	1.3	0.0	0.0	1.67	2.66	0.0	0.0
Other Pesticides	3.7	4.6	0.8	1.3	6.44	4.07	2.67	2.17
	Percent of Cases with Disability				**Average Number of Days Off Work**			
	Definite/Probable		Possible		Definite/Probable		Possible	
Type of Pesticide	1994	1982-1993	1994	1982-1993	1994	1982-1993	1994	1982-1993
Antimicrobials	14.7	21.6	17.2	15.7	2.0	3.8	15.7	4.94
Other Pesticides	22.7	26.9	24.0	22.1	4.34	4.57	2.91	3.83

TABLE 4
Illnesses/Injuries Reported in 1994
With Confirmed Relationship to Pesticide Exposure
Summarized by Pesticide(s), Type of Illness and Degree of Relationship

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		**TOTAL**	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
2,4-D	0	0	0	1	0	0	0	0	0	1
ABAMECTIN	0	0	1	0	0	1	0	0	1	1
ACEPHATE	2	1	0	0	0	0	0	0	2	1
ALDICARB	0	1	0	0	0	0	0	0	0	1
ALLETHRIN	1	0	0	0	1	0	0	0	2	0
ALUMINUM PHOSPHIDE	2	4	0	0	0	0	0	0	2	4
AZINPHOS-METHYL	0	1	0	0	0	0	0	0	0	1
BENDIOCARB	4	1	0	0	0	0	0	0	4	1
BIFENTHRIN	0	0	0	0	1	0	0	0	1	0
BORIC ACID	1	0	0	0	0	0	0	0	1	0
CALCIUM HYPOCHLORITE	1	1	4	0	0	0	0	0	5	1
CAPTAN	1	0	1	0	0	0	0	0	2	0
CARBARYL	0	0	0	1	0	0	0	0	0	1
CARBOFURAN	0	1	0	0	0	0	0	0	0	1
CHLORHEXIDINE DIACETATE	0	0	1	0	0	1	0	0	1	1
CHLORINE GAS	61	3	0	0	0	1	0	0	61	4
CHLORINE DIOXIDE	0	6	0	0	0	0	0	0	0	6
CHLOROTHALONIL	0	0	0	0	0	1	0	0	0	1

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		**TOTAL**	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
CHLORPYRIFOS	66	27	2	3	0	1	1	0	69	31
COPPER HYDROXIDE	14	0	0	0	1	1	0	0	15	1
COPPER NAPHTHENATE	1	1	0	1	0	0	0	0	1	2
COPPER SULFATE	0	0	1	0	0	0	0	0	1	0
CREOSOTE	0	0	0	0	1	0	0	0	1	0
CYANURIC ACID	6	0	10	0	1	2	0	0	17	2
CYFLUTHRIN	1	4	0	0	1	0	2	0	4	4
CYPERMETHRIN	2	3	1	1	1	1	0	0	4	5
DAMINOZIDE	0	1	0	0	0	0	0	0	0	1
DDVP	13	1	0	0	0	0	0	0	13	1
DELTAMETHRIN	1	0	0	0	0	0	0	0	1	0
DIAZINON	7	12	2	1	1	0	0	0	10	13
DICOFOL	1	0	0	0	1	0	0	0	2	0
DIMETHOATE	3	1	0	0	0	0	1	0	4	1
DIQUAT	0	1	0	0	2	0	0	0	2	1
DISULFOTON	0	2	0	0	0	0	0	0	0	2
ENDOSULFAN	0	0	0	0	0	1	0	0	0	1
ESFENVALERATE	1	0	0	0	0	0	0	0	1	0
ETHEPHON	0	1	1	0	0	0	0	0	1	1
ETHYLENE OXIDE	0	2	0	0	0	0	0	0	0	2
FONOFOS	0	1	1	0	0	0	0	0	1	1
FORMALDEHYDE	1	0	1	0	0	0	0	0	2	0

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		**TOTAL**	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
GLUTARALDEHYDE	17	3	11	0	2	1	0	0	30	4
GLYPHOSATE	2	5	11	1	0	6	0	0	13	12
HALOGENATED HYDANTOIN	0	0	2	0	0	0	0	0	2	0
HYDROGEN CHLORIDE	3	0	0	0	0	0	0	0	3	0
IPRODIONE	0	4	0	1	0	2	0	0	0	7
KATHON	0	0	0	0	1	0	0	0	1	0
LIME-SULFUR	0	1	0	0	0	1	0	0	0	2
LINURON	1	0	0	0	0	0	0	0	1	0
MALATHION	27	6	0	0	1	0	1	0	29	6
METAM-SODIUM	2	1	1	0	6	0	0	0	9	1
METHAMIDOPHOS	0	0	0	0	0	2	0	0	0	2
METHIDATHION	0	2	0	0	0	0	0	0	0	2
METHOMYL	3	2	1	0	0	0	0	0	4	2
METHYL BROMIDE	0	3	0	0	2	0	0	0	2	3
METHYL ISOTHIOCYANATE	0	1	0	0	0	0	0	0	0	1
MEVINPHOS	0	12	0	0	0	1	0	0	0	13
NAPROPAMIDE	0	1	0	0	1	0	0	0	1	1
OXYFLUORFEN	0	0	0	0	1	0	0	0	1	0
PARA-DICHLOROBENZENE	1	0	0	0	0	0	0	0	1	0
PENDIMETHALIN	0	1	0	0	0	0	0	0	0	1
PERMETHRIN	1	1	0	0	0	1	0	0	1	2
PHENOLIC DISINFECTANTS	1	2	6	0	3	0	0	0	10	2

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		**TOTAL**	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
PINE OIL	1	1	7	0	0	0	0	0	8	1
PROMETON	0	0	0	0	1	0	0	0	1	0
PROPARGITE	1	2	1	1	5	0	0	1	7	4
PROPETAMPHOS	1	0	0	0	0	1	0	0	1	1
PROPOXUR	8	4	2	0	0	0	0	0	10	4
PROPYLENE OXIDE	0	1	0	0	0	0	0	0	0	1
PYRETHRINS/PIPERONYL BUTOXIDE	9	2	2	0	1	1	0	0	12	3
QUATERNARY AMMONIA	4	4	54	2	18	5	2	0	78	11
RESMETHRIN	21	1	0	0	0	1	0	0	21	2
SABADILLA	0	1	0	0	0	0	0	0	0	1
SETHOXYDIM	0	0	1	0	0	0	0	0	1	0
SODIUM CHLORITE	0	1	0	0	0	0	0	0	0	1
SODIUM CYANIDE	0	1	0	0	0	0	0	0	0	1
SODIUM HYPOCHLORITE	51	18	101	4	5	6	6	1	163	29
STREPTOMYCIN	0	0	0	0	1	0	0	0	1	0
STRYCHNINE	0	2	0	0	0	0	0	0	0	2
SULFUR	11	6	12	0	2	9	0	1	25	16
SULFUR DIOXIDE	1	0	0	0	0	0	0	0	1	0
SULFURYL FLUORIDE	4	0	0	0	0	0	0	0	4	0
TETRACHLORVINPHOS	0	1	0	0	0	0	0	0	0	1
TRIADIMEFON	0	0	1	0	0	0	0	0	1	0
TRICHLOROMELAMINE	0	0	0	0	1	4	0	0	1	4

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		**TOTAL**	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
TRIFLURALIN	0	2	0	1	1	0	0	0	1	3
ZINC CHLORIDE	0	0	1	0	0	0	0	0	1	0
COMBINATIONS OF CHOLINESTERASE-INHIBITING INSECTICIDES	11	53	1	3	0	6	0	2	12	64
COMBINATIONS OF INSECTICIDES OTHER THAN CHOLINESTERASE INHIBITORS	10	7	1	2	0	1	0	0	11	10
COMBINATIONS OF INSECTICIDES INCLUDING BOTH CHOLINESTERASE INHIBITOR(S) AND OTHER(S)	54	31	3	0	1	4	1	0	59	35
COMBINATIONS OF HERBICIDES/DEFOLIANTS	8	9	4	1	3	1	1	0	16	11
COMBINATIONS OF FUNGICIDES	13	5	1	2	3	8	0	0	17	15
COMBINATIONS OF FUNGICIDE(S) WITH CHOLINESTERASE-INHIBITING INSECTICIDE(S)	0	5	1	1	0	2	0	0	1	8
COMBINATIONS OF FUNGICIDE(S) WITH INSECTICIDE(S) OTHER THAN CHOLINESTERASE INHIBITORS	0	4	1	0	1	3	0	0	2	7
COMBINATIONS OF FUNGICIDE(S) WITH BOTH CHOLINESTERASE-INHIBITING AND OTHER INSECTICIDES	1	7	0	3	0	3	0	0	1	13
COMBINATIONS OF FUNGICIDE(S) WITH PLANT GROWTH REGULATOR(S)	0	3	0	0	0	2	0	0	0	5
COMBINATIONS OF FUMIGANTS	4	0	0	1	0	0	0	0	4	1
COMBINATIONS OF ANTIMICROBIALS	20	7	20	0	5	6	3	0	48	13
MISCELLANEOUS COMBINATIONS	5	4	1	0	1	2	0	0	7	6
UNKNOWN PESTICIDES	10	19	12	2	3	4	0	0	25	25
TOTAL	**496**	**322**	**285**	**33**	**80**	**93**	**18**	**5**	**879**	**453**

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
ALAMEDA						
Definite	16	1	13	2	0	16
Probable	9	0	7	2	0	9
Possible	5	1	2	0	1	4
Unlikely	18	0	15	2	0	18
Asymptomatic	1					
Unrelated	7					
AMADOR						
Definite	2	0	2	0	0	2
BUTTE						
Definite	3	0	2	0	0	3
Probable	48	0	48	0	0	48
Possible	7	0	4	2	2	5
Unlikely	2	0	2	0	1	1
Unrelated	4					
Insufficient	1					
CALAVERAS						
Probable	1	0	1	0	1	0
COLUSA						
Definite	2	1	0	1	1	1
Possible	1	0	0	1	1	0
CONTRA COSTA						
Definite	9	0	6	0	1	8
Probable	1	1	0	0	0	1
Possible	5	0	4	1	0	5
Unlikely	1	1	0	0	0	1
Unrelated	8					
Unavailable	3					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
DEL NORTE						
Definite	1	0	1	0	0	1
Probable	1	0	0	1	1	0
Unrelated	1					
EL DORADO						
Definite	2	0	2	0	0	2
Unlikely	1	0	1	0	0	1
Unrelated	1					
FRESNO						
Definite	32	2	27	2	14	18
Probable	35	1	14	20	29	6
Possible	28	1	15	12	19	9
Unlikely	5	0	1	4	5	0
Asymptomatic	3	0	0	3	2	1
Unrelated	36					
Unavailable	4					
GLENN						
Probable	4	1	3	0	1	3
Possible	4	0	1	3	4	0
HUMBOLDT						
Definite	5	0	4	0	0	5
Probable	2	0	2	0	0	2
Possible	5	0	4	1	0	5
Unrelated	2					
Insufficient	2					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
IMPERIAL						
Definite	2	0	1	1	2	0
Probable	3	0	1	2	3	0
Possible	17	0	5	12	17	0
Unlikely	7	0	0	7	7	0
Asymptomatic	8	0	0	8	8	0
Unrelated	7					
Insufficient	1					
KERN						
Definite	7	1	4	0	3	4
Probable	9	2	3	3	4	5
Possible	16	0	6	10	12	4
Unlikely	8	0	1	7	7	1
Indirect	1	0	0	1	1	0
Asymptomatic	9	0	0	0	0	9
Unrelated	16					
KINGS						
Definite	3	0	3	0	1	2
Probable	51	0	51	0	50	1
Possible	5	0	5	0	5	0
Asymptomatic	7	0	6	0	7	0
Unrelated	8					
Insufficient	1					
Unavailable	1					
LASSEN						
Definite	1	0	0	1	1	0
Possible	2					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
LOS ANGELES						
Definite	37	2	28	0	0	37
Probable	60	0	27	28	0	60
Possible	37	0	14	20	2	35
Unlikely	11	0	5	0	0	11
Asymptomatic	2	0	2	0	0	2
Unrelated	65					
Insufficient	4					
Unavailable	10					
MADERA						
Definite	3	0	2	0	2	1
Probable	1	0	1	0	1	0
Possible	5	0	4	1	5	0
Unlikely	1	0	1	0	1	0
Unrelated	7					
Unavailable	1					
MARIN						
Definite	1	0	0	0	0	1
Possible	1	0	0	0	0	1
Unlikely	1	0	1	0	0	1
Unrelated	1					
MARIPOSA						
Probable	1	0	1	0	0	1
Unavailable	1					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
MENDOCINO						
Definite	3	1	2	0	0	3
Probable	5	0	5	0	0	5
Possible	2	0	1	1	2	0
Asymptomatic	1	0	0	0	0	1
Unrelated	2					
MERCED						
Definite	6	0	3	3	3	3
Probable	6	0	4	2	5	1
Possible	9	0	7	1	8	1
Asymptomatic	1	0	1	0	1	0
Unrelated	15					
Insufficient	1					
MODOC						
Probable	1	0	1	0	0	1
Unrelated	3					
MONTEREY						
Definite	8	1	7	0	4	4
Probable	8	0	5	3	3	5
Possible	22	0	11	11	17	5
Unlikely	3	0	1	2	2	1
Asymptomatic	2	0	2	0	2	0
Unrelated	11					
Insufficient	4					
Unavailable	1					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
NAPA						
Definite	6	1	5	0	2	4
Probable	4	0	0	3	2	2
Possible	5	0	1	4	4	1
Unlikely	2	0	2	0	0	2
Unrelated	2					
NEVADA						
Definite	2	0	2	0	0	2
Possible	1	0	0	1	0	1
Unrelated	1					
ORANGE						
Definite	17	1	14	1	0	17
Probable	19	0	12	2	0	19
Possible	14	1	7	5	0	14
Unlikely	3	0	0	3	1	2
Asymptomatic	1	0	0	0	0	1
Unrelated	19					
Insufficient	1					
Unavailable	4					
PLACER						
Definite	2	0	2	0	0	2
Probable	35	0	1	12	0	35
Possible	5	0	1	1	0	5
Asymptomatic	1	1	0	0	0	1
Unrelated	1					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
RIVERSIDE						
Definite	13	0	11	2	0	13
Probable	20	5	8	3	1	19
Possible	13	0	8	4	1	12
Unlikely	3	0	1	1	1	2
Asymptomatic	1	0	1	0	0	1
Unrelated	16					
Insufficient	1					
Unavailable	2					
SACRAMENTO						
Definite	13	1	10	1	0	13
Probable	22	0	10	9	2	20
Possible	18	0	9	9	1	17
Asymptomatic	1	0	0	0	0	1
Unrelated	8					
Insufficient	2					
Unavailable	1					
SAN BENITO						
Definite	2	0	0	1	0	2
Probable	4	4	0	0	0	4
Unrelated	2					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
SAN BERNARDINO						
Definite	9	1	7	1	0	9
Probable	23	0	11	10	0	23
Possible	17	0	2	14	0	17
Unlikely	1	0	0	1	0	1
Asymptomatic	2	0	2	0	0	2
Unrelated	9					
Insufficient	1					
Unavailable	1					
SAN DIEGO						
Definite	29	2	22	1	1	28
Probable	43	1	13	24	17	26
Possible	25	0	10	10	11	14
Unlikely	8	0	3	4	2	6
Indirect	1	0	1	0	1	0
Asymptomatic	2	0	1	0	0	2
Unrelated	33					
Insufficient	2					
Unavailable	3					
SAN FRANCISCO						
Definite	10	0	8	0	0	10
Probable	8	0	3	5	0	8
Possible	2	0	1	0	0	2
Unrelated	3					
Unavailable	3					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
SAN JOAQUIN						
Definite	13	1	11	0	2	11
Probable	15	0	5	0	2	13
Possible	15	1	4	10	9	6
Asymptomatic	1	0	0	0	0	1
Unrelated	11					
Insufficient	2					
Unavailable	3					
SAN LUIS OBISPO						
Definite	7	0	4	1	1	6
Probable	8	0	6	0	3	5
Possible	4	0	3	1	3	1
Unlikely	2	0	1	0	1	1
Asymptomatic	2	0	2	0	0	2
SAN MATEO						
Definite	12	0	9	3	0	12
Probable	5	0	5	0	0	5
Possible	5	0	3	2	1	4
Unlikely	1	0	0	1	1	0
Asymptomatic	1	0	0	0	0	1
Unrelated	7					
Insufficient	1					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
SANTA BARBARA						
Definite	6	1	5	0	2	4
Probable	2	1	1	0	0	2
Possible	8	0	7	1	8	0
Unlikely	1	0	1	0	1	0
Asymptomatic	3	0	1	2	1	2
Unrelated	5					
Insufficient	3					
Unavailable	1					
SANTA CLARA						
Definite	15	0	13	1	1	14
Probable	18	1	9	7	0	18
Possible	22	0	8	11	6	16
Unrelated	24					
Insufficient	7					
Unavailable	2					
SANTA CRUZ						
Definite	4	0	3	0	1	3
Probable	1	0	1	0	1	0
Possible	5	1	2	2	3	2
Unlikely	1	0	1	0	1	0
Unrelated	4					
Insufficient	1					
SHASTA						
Definite	1	0	1	0	0	1
Probable	2	0	2	0	0	2
Possible	2	0	1	1	0	2
Unavailable	1					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
SIERRA						
Probable	1	0	1	0	0	1
Possible	1	0	1	0	0	1
SISKIYOU						
Probable	1	0	0	1	0	1
Possible	2	0	0	0	0	2
Unrelated	2					
Unavailable	1					
SOLANO						
Definite	6	0	6	0	1	5
Probable	4	0	4	0	0	4
Possible	2	0	2	0	0	2
Unlikely	1	0	0	1	1	0
Asymptomatic	4	4	0	0	4	0
Unrelated	6					
Unavailable	1					
SONOMA						
Definite	5	0	5	0	0	5
Probable	4	0	2	2	0	4
Possible	8	0	3	3	5	3
Unlikely	2	0	1	1	1	1
Unrelated	6					
Insufficient	2					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
STANISLAUS						
Definite	11	0	6	1	3	8
Probable	24	0	11	13	19	5
Possible	14	0	7	6	12	2
Unlikely	1	0	0	1	1	0
Asymptomatic	1	0	0	0	0	1
Unrelated	13					
Unavailable	1					
SUTTER						
Definite	4	0	4	0	2	2
Probable	1	0	0	0	0	1
Possible	3	0	1	1	2	1
Unlikely	1	0	0	1	1	0
Unrelated	3					
TEHAMA						
Definite	2	1	1	0	0	2
Probable	1	0	1	0	1	0
Asymptomatic	1	0	1	0	1	0
Unrelated	1					
TRINITY						
Probable	1	0	0	1	0	1
Unrelated	2					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
TULARE						
Definite	6	0	5	0	2	4
Probable	7	0	5	0	4	3
Possible	81	0	20	8	79	2
Unlikely	1	0	0	1	1	0
Asymptomatic	14	0	0	0	14	0
Unrelated	17					
Insufficient	8					
Unavailable	2					
TUOLUMNE						
Probable	2	0	2	0	0	2
Unlikely	1	0	0	1	0	1
Unrelated	3					
VENTURA						
Definite	9	0	8	1	3	6
Probable	6	1	2	1	0	6
Possible	7	0	4	3	4	3
Unlikely	4	0	1	3	3	1
Unrelated	10					
YOLO						
Definite	3	1	2	0	0	3
Probable	2	0	1	0	0	2
Possible	1	0	1	0	0	1
Unlikely	1	0	1	0	0	1
Asymptomatic	1	1	0	0	0	1
Unrelated	3					

TABLE 5

Summary of Illness/Injury Incidents
Reported by Physicians According to County of Occurrence*
1994

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate[1]	Pesticide Use[2]	Pesticide Residue[3]	Agric.	Non-Agric.
YUBA						
Definite	2	0	2	0	0	2
Possible	2	0	0	2	1	1
TOTALS:						
Definite	**355**	**20**	**276**	**23**	**53**	**302**
Probable	**524**	**17**	**286**	**154**	**148**	**376**
Possible	**453**	**5**	**190**	**176**	**247**	**206**
Unlikely	**74**	**1**	**25**	**39**	**39**	**35**
Indirect	**2**	**0**	**1**	**1**	**2**	**0**
Asymptomatic	**69**	**6**	**19**	**13**	**40**	**29**
Overall	**1478**	**49**	**797**	**406**	**529**	**949**
Unrelated	**416**					
Insufficient	**46**					
Unavailable	**56**					

* Type of exposure determined by activity at time of exposure

[1] Exposure to concentrate includes exposure incurred in the process of manufacture, formulation, response to emergencies, or while handling pesticide containers in the course of shipping, warehousing or retailing.

[2] Exposure via pesticide use includes exposures to mixers, loaders, applicators, flaggers, fumigators and people exposed to drift.

[3] Exposure to residue includes residues in the field, on commodities being packed or processed, on equipment being serviced, reuslting from structural applications, or any other residue encountered in the course of employment.

TABLE 6

Distribution of Agricultural and Non-Agricultural Drift and Residue Cases In Relation to Type of Pesticide and Odor as a Contributory Factor 1994

Pesticide Type and Type of Use	DRIFT		RESIDUE	
	Odor Present	No Odor Present	Odor Present	No Odor Present
AGRICULTURAL USE				
Cholinesterase Inhibitors	107	14	14	42
Other Pesticides	10	26	27	66
NON-AGRICULTURAL USE				
Cholinesterase Inhibitors	22	7	84	49
Other Pesticides	61	48	46	59

TABLE 7

Classification of Cases By Symptom Type and Pesticide Type 1994

Pesticide Type and Type of Symptoms	Definite	Probable	Possible	Unlikely	Indirect
EYE SYMPTOMS ONLY					
Antimicrobials	203	23	7	3	0
ChE Inhibitors	8	5	12	2	0
Other Pesticides	29	17	14	2	0
SKIN SYMPTOMS, WITH OR WITHOUT EYE INVOLVEMENT					
Antimicrobials	30	21	30	2	1
ChE Inhibitors	3	4	25	7	0
Other Pesticides	18	22	43	12	1
SYSTEMIC OR RESPIRATORY SYMPTOMS WITH OR WITHOUT EYE OR SKIN INVOLVEMENT					
Antimicrobials	30	141	50	9	0
ChE Inhibitors	20	183	182	16	0
Other Pesticides	14	108	90	21	0